

# What canopy structure can tell us about plant productivity



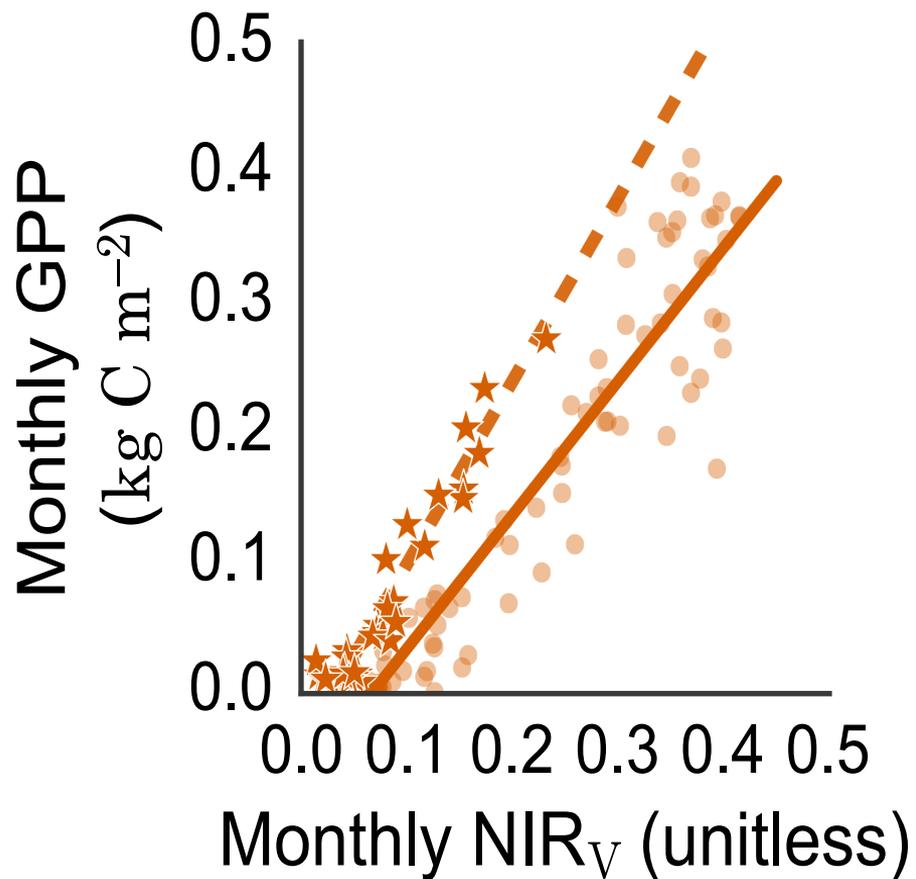
Grayson Badgley  
Columbia University

# Outline

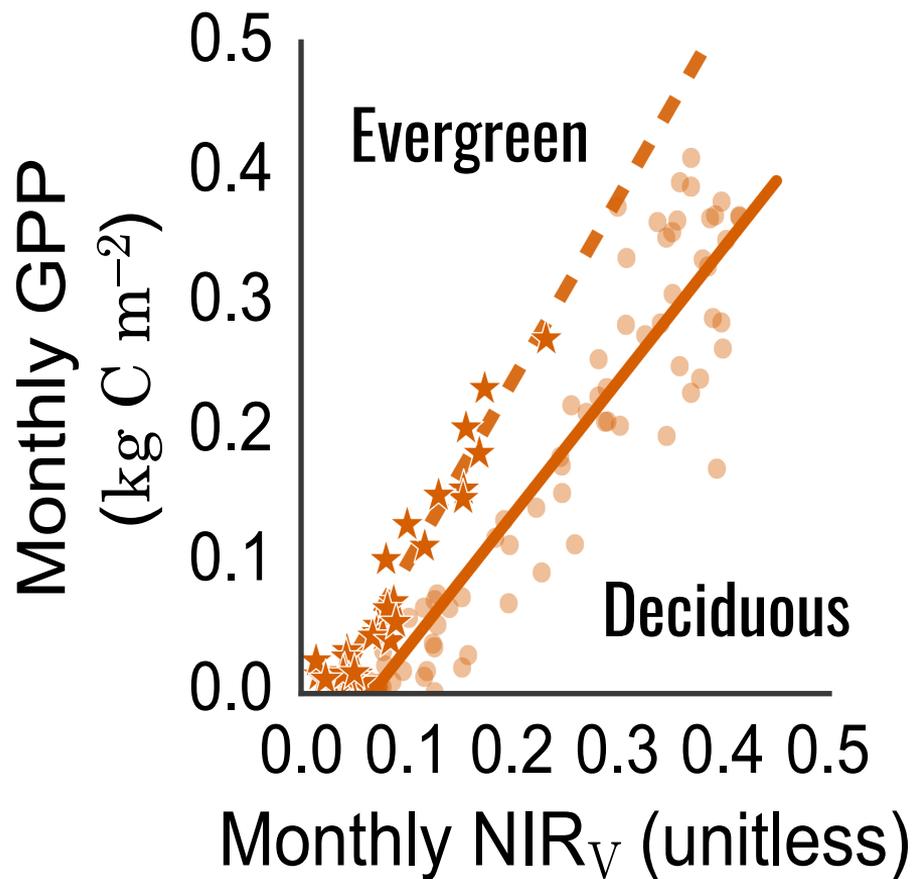
1. Introduce NIRv: near-infrared reflectance of vegetation
2. NIRv as a predictor of GPP
3. Why NIRv works: functional convergence

$$NIR_V = NDVI \cdot NIR$$

# NIRv predicts site-level fluxes

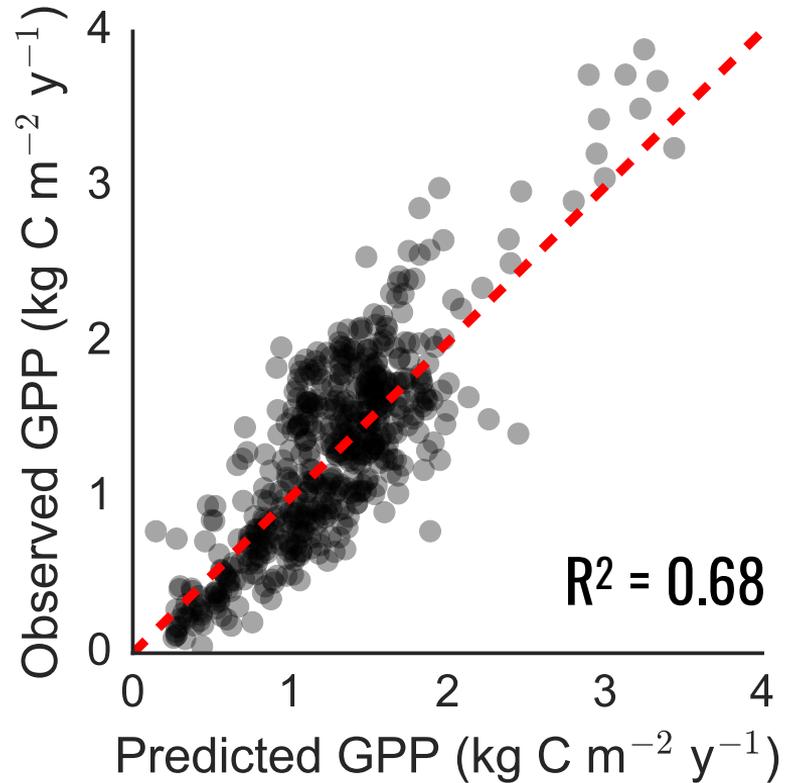


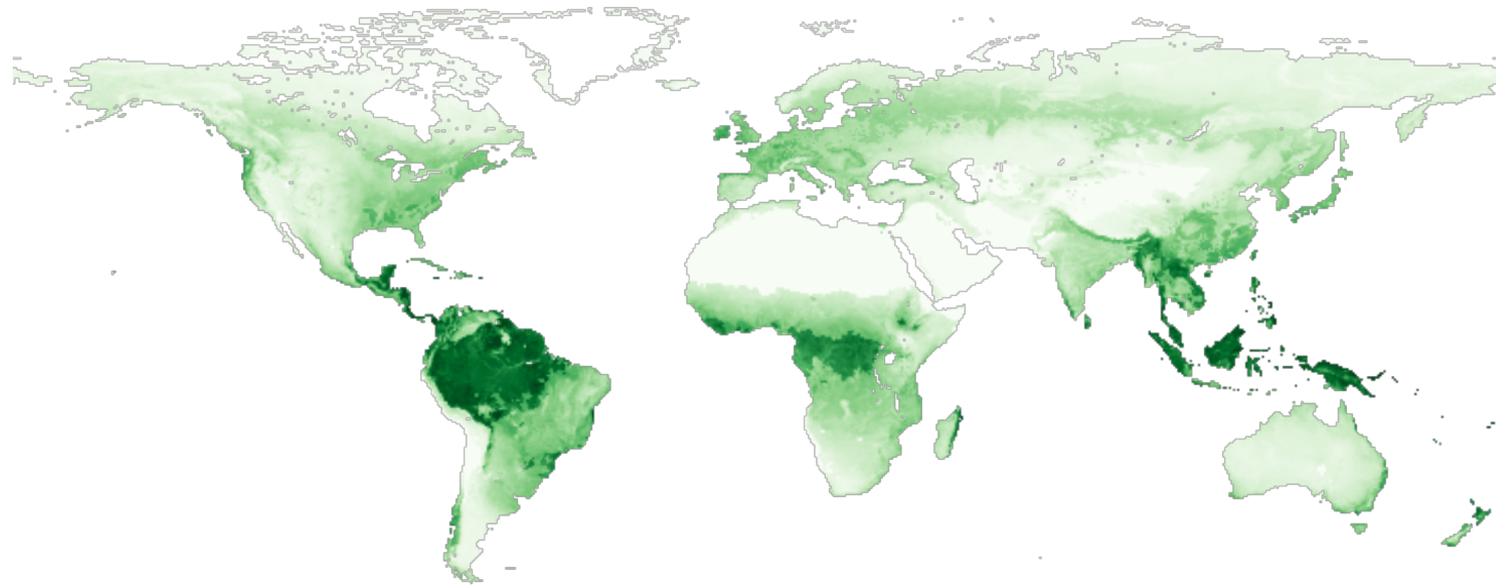
# Slope varies by evergreen/deciduous



# Two-Input Model

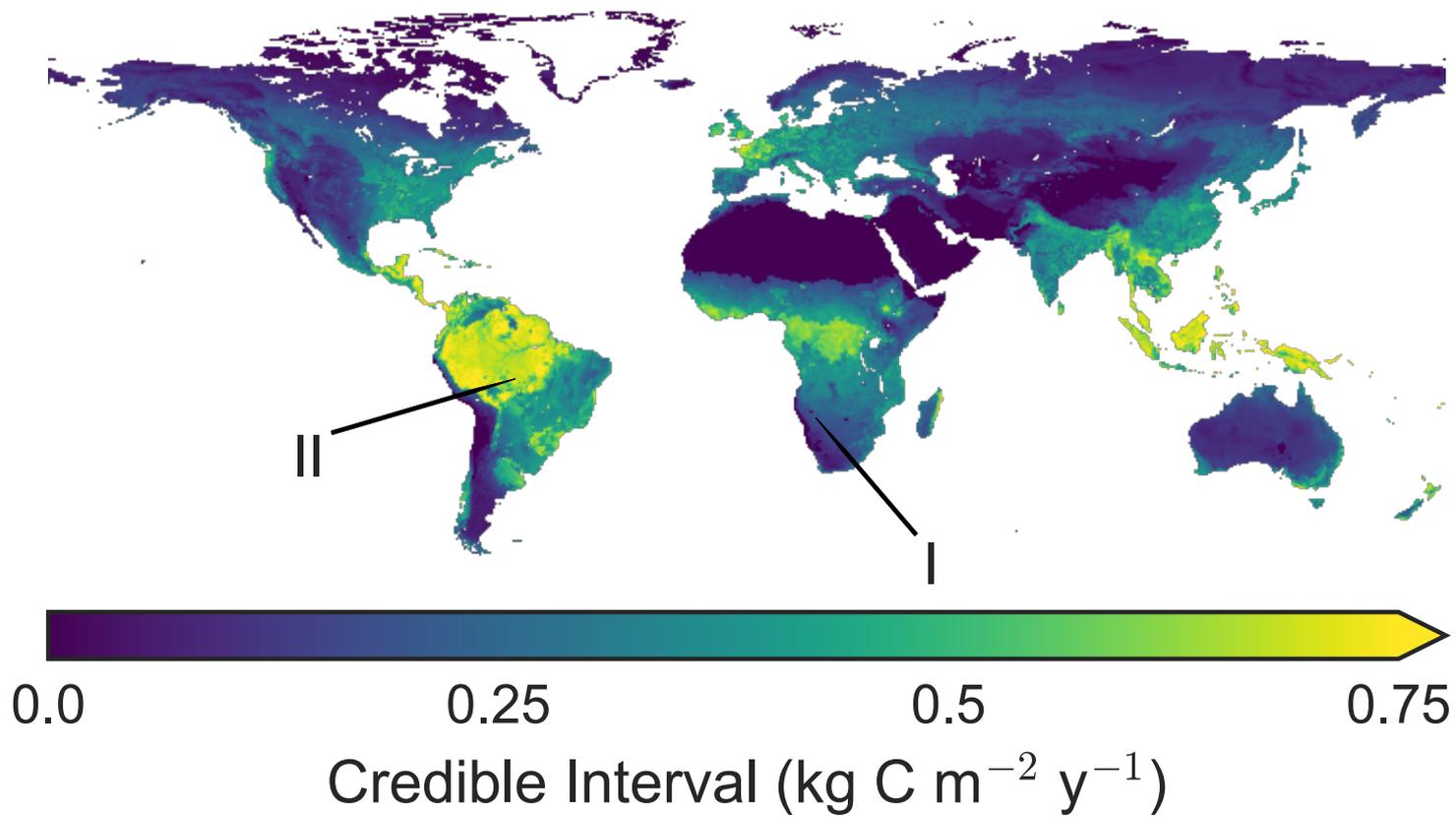
- Annual Sum NIRv
- Deciduous/Evergreen

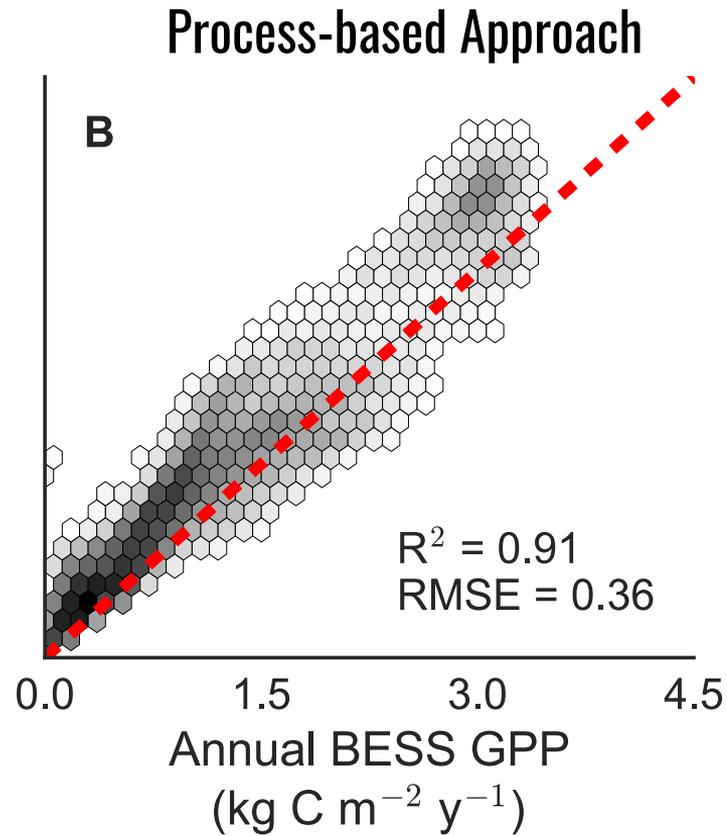
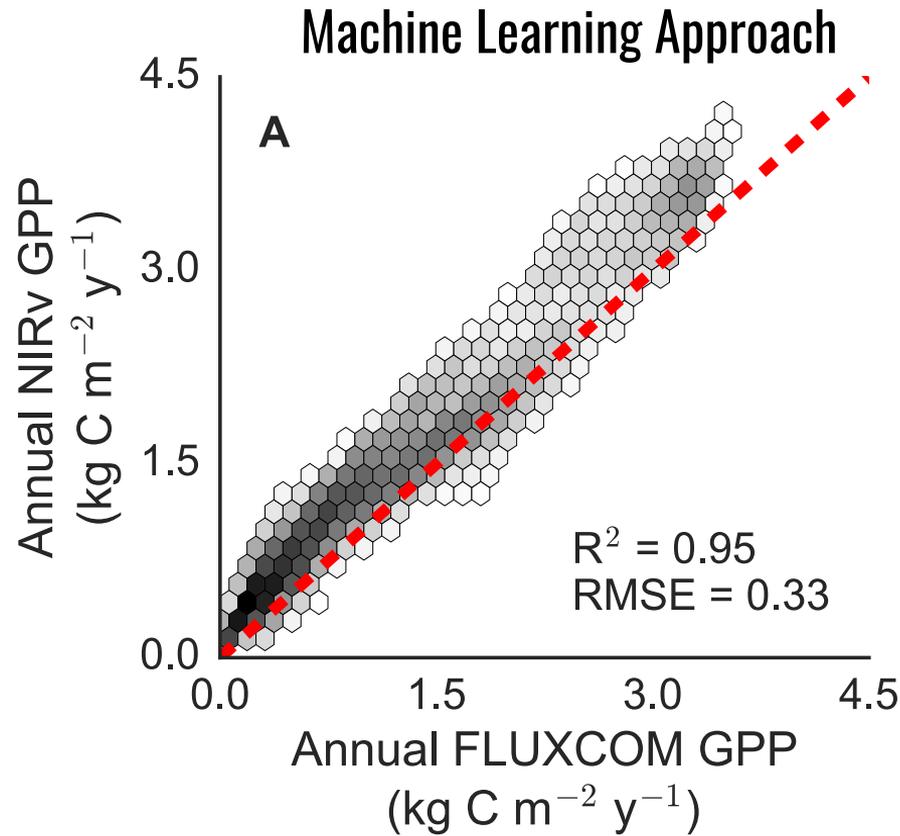




0 1 2 3 4

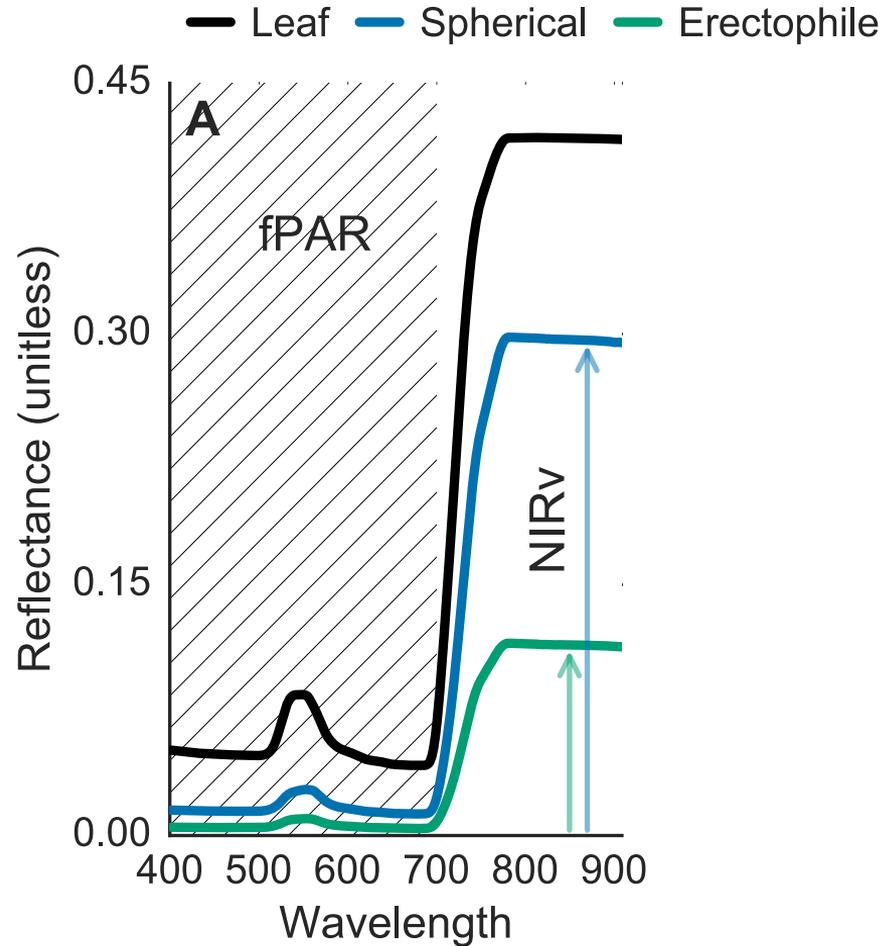
GPP ( $\text{kg C m}^{-2} \text{y}^{-1}$ )



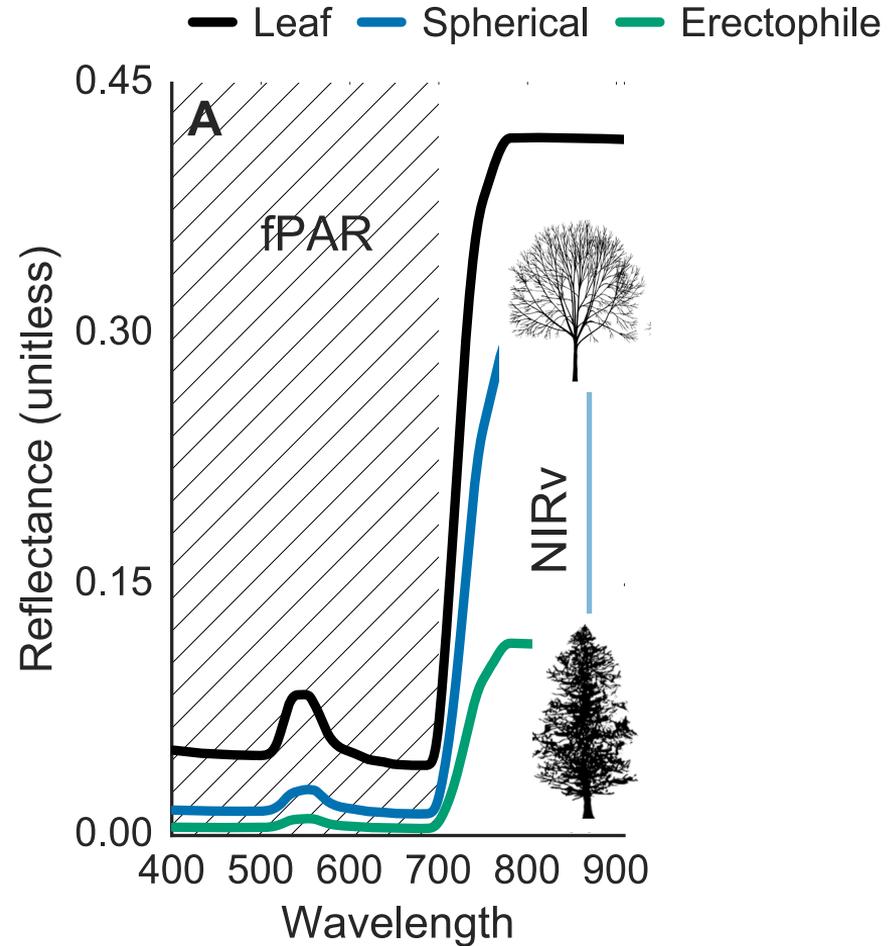


# NIRv measures canopy structure

# NIRv captures structure



# NIRv captures structure



# Leaf Angle, Anatomy & Clumping

- Thick leaves
  - Tightly clumped
- >> Low photosynthetic capacity



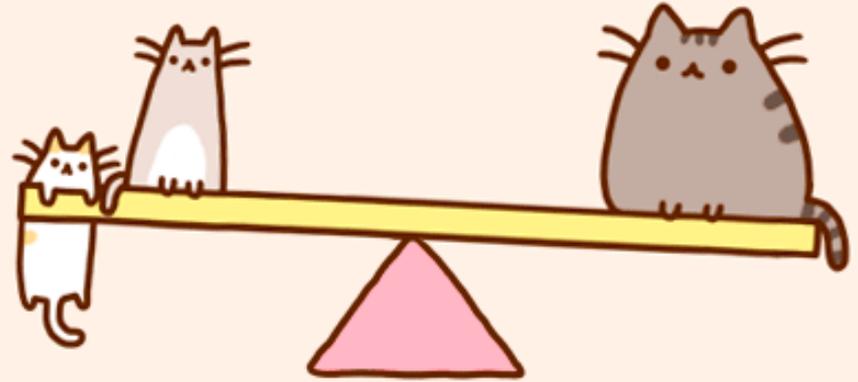
# Leaf Angle, Anatomy & Clumping

- Thick leaves • Thin leaves
- Tightly clumped • Loosely packed
- >> Low photosynthetic capacity >> High photosynthetic capacity



# Coordination of investments

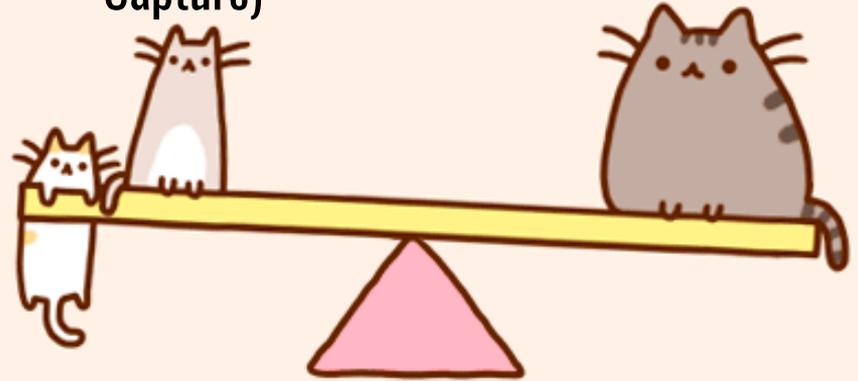
## Structure



# Coordination of investments

## Structure

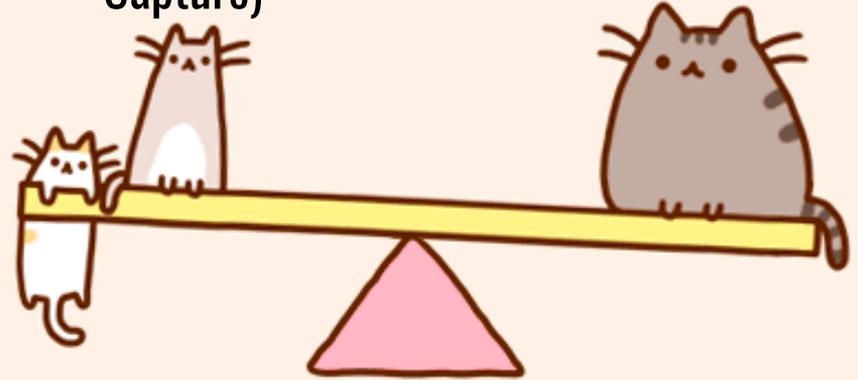
(Investment in Light  
Capture)



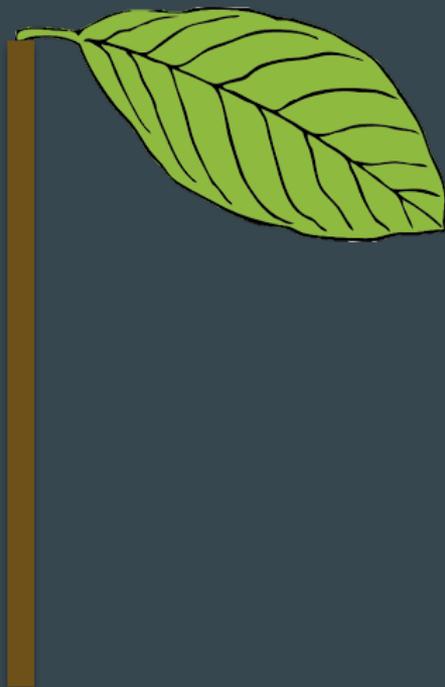
# Coordination of investments

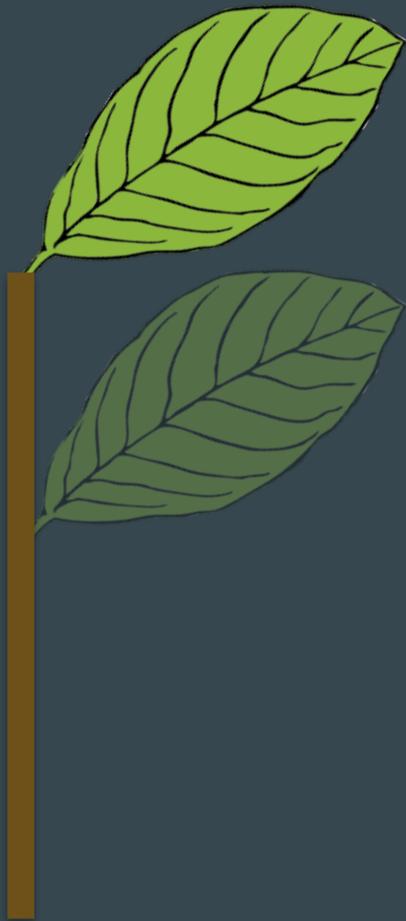
**Structure**  
(Investment in Light  
Capture)

**Function**  
(Photosynthesis)



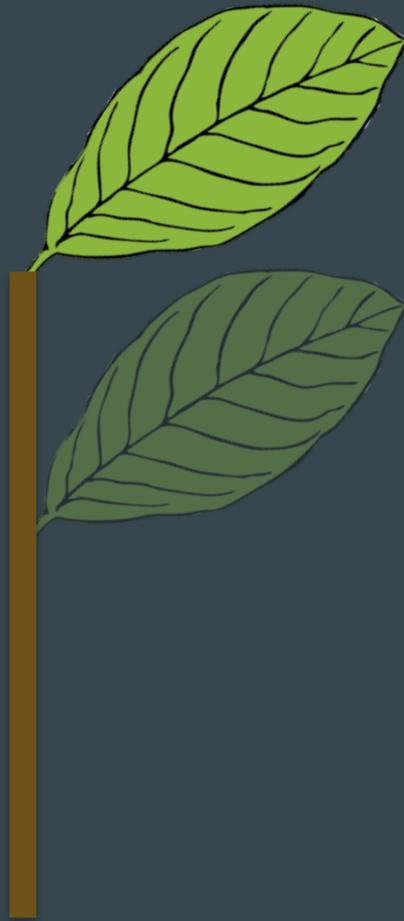
# Canopy structure in terrestrial ecosystem models





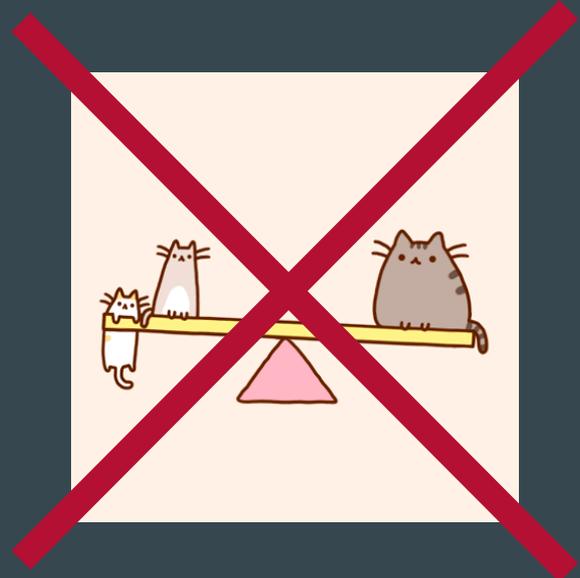
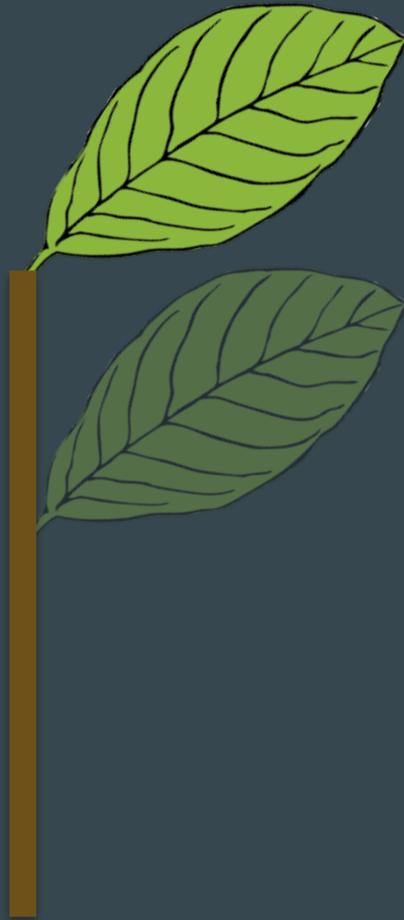
Structure is constant:

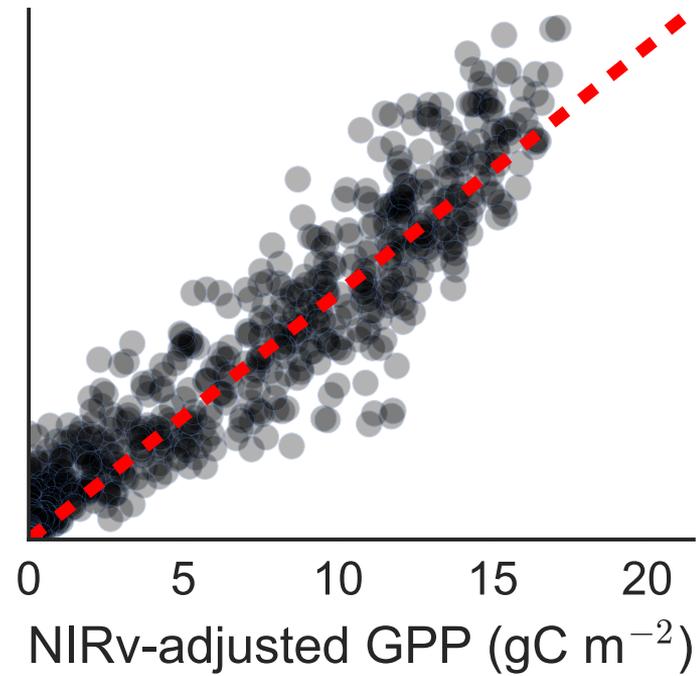
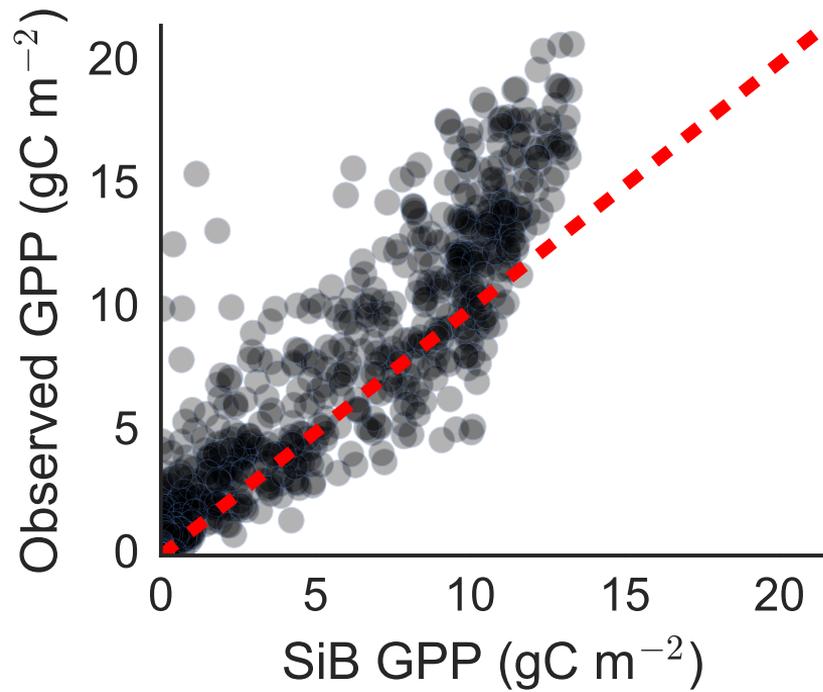
- In space
- Through time



Structure is constant:

- In space
- Through time





## collaborators

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